

# PATENT SPECIFICATION

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## (54) A SELF-CLEANING FILTER FOR REMOVING SUSPENDED MATTER FROM A LIQUID

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Republics, all Corporations organised and  
existing under the laws of the Union of  
Soviet Socialist Republics, do hereby  
declare the invention, for which we pray  
that a patent may be granted to us, and the  
method by which it is to be performed, to be  
particularly described in and by the  
following statement:—

The present invention relates to a filter  
for removing suspended matter from a  
liquid.

It is envisaged that filters in accordance  
with the present invention will be useful in  
various industries, e.g. the chemical,  
metallurgical, paper and food industries,  
and will be especially useful for removing  
suspended matter from river water, utility  
and return water, industrial waste water and  
fruit and vegetable juices.

Known in the prior art are self-cleaning  
filters for removing suspended matter from  
liquids (see, for example, USSR Author's  
Certificate No. 210092). Such a filter  
comprises: a container accommodating at  
least two filtering partitions which divide the  
interior of the container into sections for

contaminated liquid, i.e. liquid containing  
suspended matter, and at least one section  
for cleaned liquid, i.e. liquid from which  
suspended matter has been removed, the  
section or sections for cleaned liquid being  
disposed between the sections for con-  
taminated liquid; inlets and outlets for  
delivering contaminated liquid into the  
sections for contaminated liquid and  
discharging cleaned liquid from the section  
or sections for cleaned liquid; and devices  
for backwashing the filtering partitions.  
Each backwashing device is installed in a  
respective one of the sections for con-  
taminated liquid, is movable over the  
corresponding filtering partition, and is  
flexibly pressed against the corresponding  
filtering partition. Each backwashing device  
comprises a hollow body having an opening  
facing the corresponding filtering partition,  
the interior of the hollow body com-  
municating with the atmosphere, a mating  
plate extending completely around the  
opening of the hollow body.

In use of the filter, the contaminated  
liquid is fed into the filter under pressure.

Each backwashing device is mounted in a  
frame which is secured rigidly on a hollow  
drive shaft. The hollow body of the back-  
washing device is movable relative to the  
frame and is connected therewith by six  
springs, three at each side of the hollow  
body. The six springs press the hollow body  
against the corresponding filtering partition.  
The mating plate is made of metal, e.g.  
bronze, and is rigidly secured to the hollow  
body.

Inevitable nonuniform tension of the

5 springs causes the body and the mating plate to become cocked relative to the filtering partition. As a result, the mating plate is subjected to heavy wear since only one edge of the mating plate, instead of the entire lower surface of the mating plate, contacts the filtering partition. Moreover, the cocking of the mating plate creates a clearance between its lower surface and the filtering partition. Contaminated liquid leaks through this clearance directly into the body of the backwashing device and is discharged from the filter through the hollow shaft thus reducing the capacity of the filter.

10 As the filtering partition becomes gradually clogged, the pressure difference between the respective sections for contaminated liquid and cleaned liquid increases, causing the filtering partition to warp. Since the mating plate is made of metal, the warping of the filtering partition prevents tight contact between the mating plate and the filtering partition being maintained while the latter is being washed. Thus a clearance is established between the mating plate and the filtering partition. The clearance between the mating plate and the filtering partition reduces the pressure difference between the section or sections for cleaned liquid and the hollow shaft communicating with the atmosphere. This reduced pressure difference impairs the quality of cleaning the filtering partition from the trapped suspended matter and, as a result, the capacity and reliability of the filter are reduced.

15 An object of the invention is to overcome or mitigate the disadvantages referred to above.

20 According to the present invention there is provided a self-cleaning filter for removing suspended matter from a liquid, the filter comprising: a container; at least two filtering partitions dividing the interior of the container into at least two first sections and at least one second section, the second section(s) being disposed between the first sections; inlets for delivering contaminated liquid i.e. liquid containing suspended matter into the first sections; at least one outlet for discharging cleaned liquid, i.e. liquid from which suspended matter has been removed, from the second section(s); respective means for backwashing the filtering partitions located in each first section, each means comprising a hollow body, the hollow body being resiliently urged against the corresponding filtering partition and being movable over the corresponding filtering partition, the hollow body having an opening facing the corresponding filtering partition, the hollow body having a recess extending substantially completely around the opening, a mating

plate being accommodated in the recess and being movable towards and away from the partition, a portion of the recess remote from the partition being unoccupied by the mating plate, the hollow body being provided with at least one hole providing communication between said portion of the recess and the corresponding first section; and means for providing communication between the interior of each hollow body and the exterior of the container.

It is preferred that the recess and mating plate of each backwashing means extend completely around the opening of the hollow body and that the recess is annular in shape.

In use of the filter of the invention, when the filtering partitions are being cleaned, each mating plate is uniformly pressed against the corresponding filtering partition due to the utilization of the pressure of the contaminated liquid in the sections for the contaminated liquid. Thus cocking of the mating plates relative to the corresponding filtering partitions is prevented thereby reducing wear of the mating plates and raising the filter capacity as compared with the prior art filters described above.

Preferably each mating plate is made of an elastic or resilient material.

When each mating plate is made of elastic or resilient material it is possible to compensate for the clearance between each mating plate and the corresponding filtering partition caused by the filtering partition warping due to a high pressure difference between the sections on either side of the filtering partition. Thus the filtering partitions can be more efficiently cleaned from suspended matter thereby increasing the capacity and reliability of the filter as compared with the prior art filter described above.

A self-cleaning filter embodying the invention is described below by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of the filter;

Figure 2 is a section of a backwashing device taken along line II—II in Figure 1;

Figure 3 is a perspective, partly cut-away view of the backwashing device; and

Figure 4 is a section of the backwashing device taken along line IV—IV in Figure 1.

The self-cleaning filter shown in the drawings comprises a vertical cylindrical container 1 (Figure 1) installed on a foundation (not shown in the drawings). The container accommodates filtering partitions 2 identical in shape to the horizontal cross section of the container 1. The partitions 2 divide the container into first sections 3 for contaminated liquid, i.e. liquid containing suspended matter, and a second section 4 for cleaned liquid, i.e. liquid from which

suspended matter has been removed. The sections 4 is disposed between the sections 3. The container 1 is provided with pipe connections 5 for delivering contaminated liquid into the sections 3 and a pipe connection 6 for discharging the cleaned liquid from the section 4. In use of the filter, the pressure difference between the sections 3 and 4 is minimal, ranging from 0.1 to 0.2 kgf/cm<sup>2</sup>.

Installed in each section 3 is a device 7 for backwashing the corresponding filtering partition 2. The device 7 is assembled in a frame 8 rigidly secured to a hollow shaft 9 which is provided with a drive 10 at its upper end. The shaft 9 is installed along the vertical axis of the container 1. The other end of the hollow shaft 9 is provided with a valve 9a for controlling communication between the interior of the shaft and the atmosphere. The backwashing device 7 has a hollow body 11 (Figures 2 and 3) which is open at the side facing the filtering partition 2 as shown in Figure 2. The body 11 has the shape of a semicylinder (as shown in Figure 3) with closed ends and its length is substantially equal to the radius of the filtering partition 2. The body 11 is movable relative to the frame 8 and is connected with the latter by springs 12 each of which is fastened at one end to the frame 8 and is secured at the other to a bracket 13 fastened rigidly to the body 11. The springs 12 press the backwashing device 7 flexibly against the filtering partition 2. At the open side of the body 11, along its entire perimeter, there is a wider portion 14 provided with an endless recess 15. The recess 15 accommodates a mating plate 16 movable towards and away from the corresponding filtering partition. The mating plate 16 is made of an elastic material, e.g. polypropylene polyethylene or caprolon (a polyamide produced by polymerising (-caprolactam in the presence of an alkali catalyst). A clearance between the face K of the mating plate and the bottom of the recess 15 forms a chamber 17. The bottom of the recess 15 beyond the space within the body 11 (as shown in Figure 3) has through holes 18 (Figures 2 and 3) which put the chamber 17 in communication with the contaminated-liquid section 3. The body 11 communicates through a flexible hose 19 (Figure 1) with the hollow shaft 9 which can communicate with the atmosphere through the valve 9a.

The self-cleaning filter functions as described below.

Contaminated liquid, is delivered under pressure through the pipe connections 5 into the sections 3 of the container 1. Passing through the filtering partitions 2, the liquid is cleaned of the suspended matter and enters the section 4 wherefrom it flows to a consumer through the pipe connection 6. As

the filtering partitions 2 become gradually clogged, their hydraulic resistance grows which causing the pressure difference between the sections 3 and 4 to increase. As the pressure difference reaches a maximum permissible level, the valve 9a is opened and the drive 10 of the hollow shaft 9 is turned on. This causes a pressure difference between the section 4 and the bodies 11 of the backwashing devices 7 which communicate with the atmosphere through the hollow shaft 9 and are pressed by springs 12 against the filtering partitions 2. As a result, part of the cleaned liquid moves in a counterflow through the filtering partitions 2 in the zones occupied at the moment by the devices 7 and washes off the trapped suspended matter into the body 11 of each backwashing device 7 wherefrom said suspended matter is removed through the hollow shaft 9.

The contaminated liquid is able to flow through the holes 18 in the bottom of the recess 15 into the chamber 17 and maintain a pressure therein which is equal to the pressure in the sections 3. As a result, the mating plate 16 is pressed still more tightly against the surface of the filtering partition, thus, ensuring tight contact between them.

Each backwashing device 7 rotates together with the shaft 9 around the vertical axis of the container 1, moving over the entire surface of the corresponding filtering partition and cleaning it from the suspended matter trapped from the liquid.

As the initial pressure difference between the sections 3 and 4 is restored, the process of washing the filtering partitions 2 is completed. The valve 9a is closed and the drive 10 of the shaft is turned off.

As the filtering partitions 2 again become clogged, washing is repeated and can be carried out on an automatic principle.

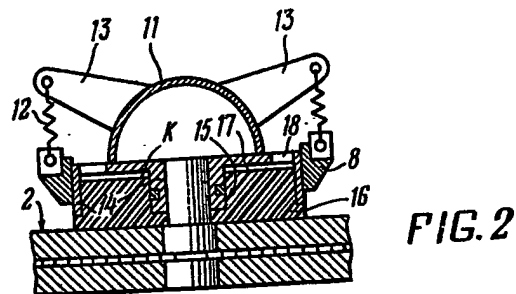
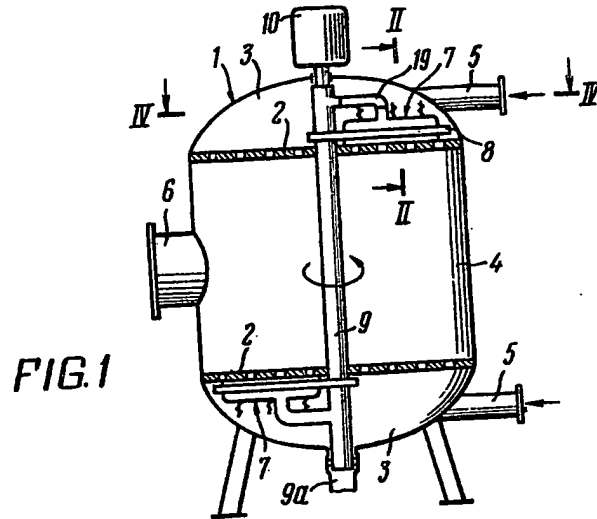
It will be appreciated that in operation of the filter described above with reference to the drawings, when the partitions are being cleaned, the mating plates do not cock relative to the corresponding partitions, and the mating plates are maintained in tight contact with the corresponding partitions. Thus, as compared with the prior art filter described earlier in this specification, the standard of cleaning of the filtering partitions, the capacity and the reliability are improved.

#### WHAT WE CLAIM IS:—

1. A self-cleaning filter for removing suspended matter from a liquid, the filter comprising: a container; at least two filtering partitions dividing the interior of the container into at least two first sections and at least one second section, the second section(s) being disposed between the first sections; inlets for delivering con-

- 5 taminated liquid i.e. liquid containing  
suspended matter into the first sections; at  
least one outlet for discharging cleaned  
liquid, i.e. liquid from which suspended  
matter has been removed, from the second  
section(s); respective means for back-  
washing the filtering partitions located in  
each first section, each means comprising a  
hollow body, the hollow body being  
resiliently urged against the corresponding  
filtering partition and being movable over  
the corresponding filtering partition, the  
hollow body having an opening facing the  
corresponding filtering partition, the hollow  
body having a recess extending substantially  
completely around the opening, a mating  
plate being accommodated in the recess and  
being movable towards and away from the  
partition, a portion of the recess remote  
from the partition being unoccupied by the  
mating plate, the hollow body being  
provided with at least one hole providing  
communication between said portion of the  
recess and the corresponding first section;  
and means for providing communication  
between the interior of each hollow body  
and the exterior of the container.
2. A filter as claimed in claim 1, wherein  
each mating plate is made of resilient  
material.
3. A filter as claimed in either preceding  
claim, wherein the recess and mating plate  
of each backwashing means extend com-  
pletely around the opening of the hollow  
body, the recess being annular in shape.
4. A filter as claimed in any preceding  
claim, wherein the hollow body of each  
backwashing means is rotatable whereby the  
hollow body is movable over the  
corresponding filtering partition.
5. A filter as claimed in claim 4, wherein  
the opening of each hollow body is radially  
elongate with respect to the axis about  
which the hollow body is rotatable.
6. A filter as claimed in claim 4 or 5  
wherein the hollow bodies are rotatable  
about a common axis whereby each hollow  
body is movable over the corresponding  
filtering partition.
7. A filter as claimed in claim 6, wherein  
the hollow bodies are mounted on a  
common shaft.
8. A filter as claimed in claim 7, wherein  
the shaft is hollow and is in communication  
with the interior of each hollow body, said  
communication between the interior of each  
hollow body and the exterior of the con-  
tainer being through said shaft.
9. A filter as claimed in any preceding  
claim, wherein the means for providing  
communication between the interior of each  
hollow body and the exterior of the con-  
tainer comprises valve means for controlling  
said communication.
10. A filter as claimed in claims 8 and 9,  
wherein the interior of each hollow body  
communicates with a common valve,  
constituting said valve means, through the  
shaft.
11. A filter substantially as described  
herein with reference to and as illustrated in  
the accompanying drawings.

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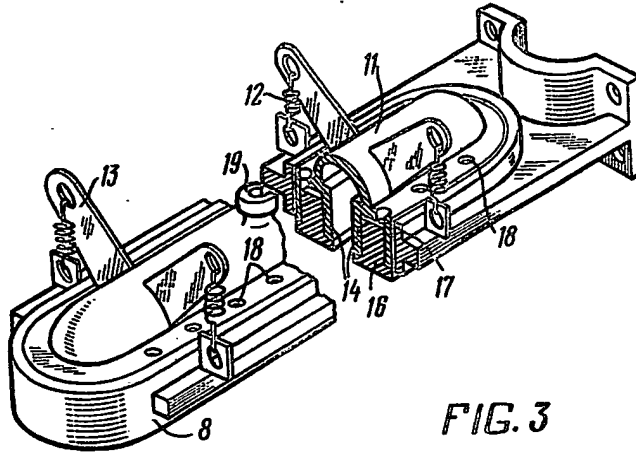


FIG. 3

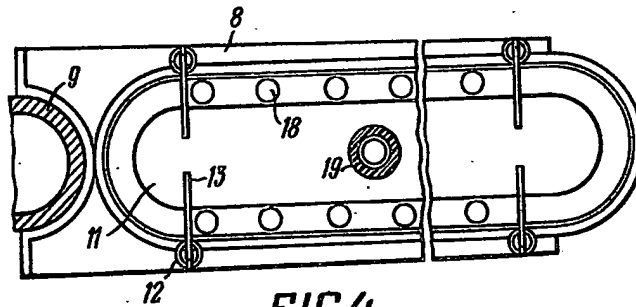


FIG. 4